

REMARKS

Upon entry of the present amendment, claims 1-22 will remain pending in the above-identified application with claims 1-14 and 16-21 standing ready for further action on the merits and claims 15 and 22 remaining withdrawn from consideration due to an earlier Restriction Requirement of the Examiner.

As seen in the Proposed Amendment, the Applicants have instantly amended "trihydric" (appearing at page 45, line 3 of the present English specification) to "trivalent". This amendment is merely a correction of an inadvertent apparent error.

As also seen in the Proposed Amendment, in order to more clearly define the present invention, the Applicant has instantly amended the claims as described below.

Claim 12 has been amended as follows:

12. (Currently Amended) The modified hydrogenated copolymer according to claim 11, which is a single-layer film, a single-layer sheet, a multilayer film having at least one layer of said modified hydrogenated copolymer, or a multilayer sheet having at least one layer of said modified hydrogenated copolymer.

Support for the insertion of a "single-layer film" and a "single-layer sheet" is found, for example, at page 103, line 6 of the present English specification. Support for the insertion of the feature "having at least one layer of said modified hydrogenated copolymer" is found at page 90, lines 11 to 14 of the present English specification.

Claim 13 has been amended to state that each of the multi-layer extrusion molding and the multilayer injection molding is effected for forming a shaped article having at least one layer of said modified hydrogenated copolymer. Support for this amendment (concerning the multilayer structure) is found at page 90, lines 11 to 14 of the present English specification.

Substantially the same amendments as in claim 12 were also effected in claim 19.

Substantially the same amendments as in claim 13 were also effected in claim 20.

Thus, no new matter has been added by the instant amendments.

The state of the art and the features and advantages of the present invention

Before specifically discussing the Examiner's rejection of the claims, it is believed that the following background information should be considered to shed a proper light on the development of the present invention and the advantageous features thereof.

As discussed in the specification under "Prior Art", although there has been a pressing need for development of a substitute material for the flexible vinyl chloride resin, a material having excellent properties (such as flexibility and abrasion resistance) which are comparable to those of the flexible vinyl chloride resin has not yet been obtained in the prior art. Further, the vinyl chloride resin and the conventional substitute materials for the vinyl chloride resin are unsatisfactory with respect to the properties of adhesion to other resins and metals. Therefore, it has been desired to improve the adhesion properties of the vinyl chloride resin and the substitute materials therefor.

In this situation, the present inventors have made extensive and intensive studies with a view toward solving the above-mentioned problems accompanying the prior art. As a result, it has unexpectedly been found that the above-mentioned problems can be solved by a modified hydrogenated copolymer comprising a hydrogenated copolymer and a functional group-containing modifier group bonded to the hydrogenated copolymer, wherein the hydrogenated copolymer is obtained by hydrogenating an unhydrogenated copolymer comprising conjugated

diene monomer units and vinyl aromatic monomer units, the unhydrogenated copolymer having at least one polymer block (H) of vinyl aromatic monomer units (hereinafter, frequently referred to as "vinyl aromatic polymer block (H)"), and wherein the modified hydrogenated copolymer having the following characteristics (1) to (4):

- (1) a content of the vinyl aromatic monomer units of from more than 60 % by weight to less than 90 % by weight, based on the weight of the hydrogenated copolymer,
- (2) a content of the vinyl aromatic polymer block (H) of from 0.1 to 40 % by weight, based on the weight of the unhydrogenated copolymer,
- (3) a weight average molecular weight of from more than 100,000 to 1,000,000, and
- (4) a hydrogenation ratio of 70 % or more, as measured with respect to the double bonds in the conjugated diene monomer units.

The present invention has been completed based on this novel finding.

Data showing the excellent effects of the present invention

With respect to the superiority of the modified hydrogenated copolymer of the present invention over the conventional modified copolymers and the like, the following should be noted. The modified hydrogenated copolymer of the present invention is advantageous in that it exhibits not only excellent properties which are achieved by conventional modified copolymers and the like (e.g., excellent properties with respect to impact resilience, anti-blocking property, and adhesion to other resins and metals), but also excellent properties with respect to abrasion resistance and flexibility, which properties cannot be achieved by the conventional modified copolymers. More specifically, in the present invention, such excellent properties with respect to

both of abrasion resistance and flexibility are achieved by the above-mentioned characteristics (1) (vinyl aromatic monomer units content of from more than 60 % by weight to less than 90 % by weight) and (2) (vinyl aromatic polymer block (H) content of from 0.1 to 40 % by weight) (see page 21, lines 12 to 19 and page 22, lines 7 to 13 of the present English specification). In other words, the above-mentioned characteristics (1) and (2) are critical for achieving excellent properties with respect to both of abrasion resistance and flexibility.

In order to substantiate this contention, the Applicants have conducted comparative experiments. The method and results of the comparative experiments are as described in Exhibit 1 of the accompanying Mr. Masahiro FUJIWARA Declaration.

The gist of Exhibit 1 of Mr. Masahiro FUJIWARA Declaration is described below.

In Experiment 1 of Exhibit 1 of Mr. Fujiwara Declaration, with respect to each of Polymer 1 and Comparative Polymers 1 to 2 indicated in Table A of Exhibit 1, abrasion resistance was evaluated in accordance with the method described at page 165, lines 4 to 18 of the present English specification. In Experiment 2 of Exhibit 1, with respect to each of Polymer 1 and Comparative Polymer 3 indicated in Table A of Exhibit 1, flexibility was evaluated in accordance with the method described at page 164, line 8 to page 165, line 1 of the present English specification. The results of Experiments 1 and 2 are shown in Table B of Exhibit 1.

For easier reference, Tables A and B of Exhibit 1 are indicated below.

Table A

	Styrene content (wt%) (characteristic (1))	Polystyrene block (H) content (wt%) (characteristic (2))	Vinyl bond content (mol%)	Weight average molecular weight (Mw)	Molecular weight distribution (Mw/Mn)	Modification		Hydrogenation ratio (%)
						Modifier **	Modification ratio (%)	
Polymer 1*	67	20	14	200,000	1.9	M1	80	99
Comparative Polymer 1	67	45	14	210,000	1.9	M1	80	99
Comparative Polymer 2	55	8	14	200,000	1.9	M1	80	99
Comparative Polymer 3	91	39	14	193,000	1.9	M1	80	99

Notes: * Polymer 1 is the polymer used in Example 1 of the present application

** M1: 1,3-dimethyl-2-imidazolidinone

Table B

	Abrasion resistance		Flexibility
	Decrease in volume (ml)	Evaluation	100% modulus (kg/cm ²)
Polymer 1	0.011	○	39
Comparative Polymer 1	0.18	×	-
Comparative Polymer 2	0.08	△	-
Comparative Polymer 3	-	-	320

Note: * The smaller the 100 % modulus, the better the flexibility

From the results, it can be fairly concluded:

that, Polymer 1 (which satisfies both of characteristics (1) and (2) recited in claim 1 of the present application) has excellent properties with respect to both of abrasion resistance and flexibility;

that, by contrast, Comparative Polymers 1 to 3 (each of which does not satisfy one of characteristics (1) and (2) recited in claim 1 of the present application) have poor abrasion resistance or poor flexibility, as compared to the properties of Polymer 1;

that thus, the instant comparative experiments show that, only when characteristics (1) and (2) recited in claim 1 of the present application are satisfied, there can be exhibited excellent properties with respect to both of abrasion resistance and flexibility; and

that, from the above, it is apparent that characteristics (1) and (2) recited in claim 1 of the present invention are critical for achieving both of excellent abrasion resistance and excellent flexibility.

Such excellent effects of the modified hydrogenated polymer of the present invention are quite unexpected from the prior art including the cited reference JP 9-316286.

Claim Rejections - 35 USC § 112

In item 4 of the office action, claims 12, 13, 19 and 20 have been rejected 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. More specifically, the Examiner states as follows:

"In these claims, the composition is stated to be in the form of a multilayer film, multilayer sheet, multilayer extrusion molding, or multilayer injection molding. However, the intended scope is indefinite because, from the language of the claims (e.g., 'which is a multilayer film'), it cannot be determined whether the articles require that the copolymer composition form at least one layer, or whether the copolymer composition is required to form more than one layer, in the overall multilayer structure."

The Applicants wish to respond as follows.

As described above, in view of the above rejection, the Applicants have amended claims 12, 13, 19 and 20.

It is believed that the rejection of these claims has been removed by the amendments.

Item 5 of the Office Action

The Examiner states as follows:

"5. Claims 1-11, 14, 16-18 and 21 are allowed over the English-language prior art currently of record. However, at the time of this Office Action, an English translation of JP 9-316286, cited as 'X' on the ISR of the PCT application, was not available. Accordingly, a complete search of the prior art was not possible.

The translation will be reviewed, and the search may need to be extended in light of the translation, at the next Office Action."
(emphasis added)

The Applicants wish to respond as follows.

In view of the Examiner's request, the Applicants hereby submit an English abstract of JP 9-316286. It is believed that the Examiner's request is satisfied by the English abstract of JP 9-316286.

The present invention has novelty and unobviousness over JP 9-316286 (hereinafter referred to as "JP '286"). This point is described below in detail.

JP '286 describes a thermoplastic elastomer composition comprising:

- (a) 100 parts by weight of a block copolymer composed of a polymer blocks (A) consisting of aromatic monoalkenyl or monoalkenylidene hydrocarbon polymers, and polymer blocks (B) consisting of hydrogenated aliphatic conjugated diene hydrocarbon polymers,
- (b) 50-400 parts by weight of an oil-extended olefin-based copolymer rubber,
- (c) 2-100 parts by weight of polyolefin resin, and
- (d) 50-350 parts by weight of a mineral oil-based softener.

JP '286 teaches that the thermoplastic elastomer composition of JP '286 is free from the problems of tacky touch and bleeding of a softener, and that the thermoplastic elastomer composition has high strength.

However, JP '286 has no teaching or suggestion about modifying a thermoplastic elastomer with a functional group-containing modifier. As can be seen from a comparison of Comparative Examples 4 to 6 of the present application with Examples 9 to 11 of the present application, unmodified hydrogenated polymer-containing compositions (produced in

Comparative Examples 4 to 6) have poor properties with respect to impact resistance and compatibility with other resins, as compared to the properties of modified hydrogenated copolymer-containing compositions (produced in Examples 9 to 11) (see page 187, line 3 to page 188, line 21 of the present English specification).

Further, JP '286 has no teaching or suggestion about the criticality of characteristics (1) and (2) recited in claim 1 of the present application for achieving excellent properties with respect to both of abrasion resistance and flexibility.

Therefore, it is apparent that a skilled person cannot achieve the modified hydrogenated copolymer of the present invention from the teachings of JP '286, taken in any respect.

From the above, it is apparent that the present invention has full patentability over JP '286.

CONCLUSION

It is believed that all rejections have been removed by the above arguments and experimental data. The present invention is now believed to be in condition for allowance.

Early favorable action is respectfully solicited.

Should there be any outstanding matters that need to be resolved in the present application, the Examiner is respectfully requested to contact John W. Bailey (Reg. No. 32,881) at the telephone number below, to conduct an interview in an effort to expedite prosecution in connection with the present application.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37.C.F.R. §§1.16 or 1.14; particularly, extension of time fees.

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Respectfully submitted,

By 

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Attachments: 37 CFR § 1.132 Declaration of Mr. Masahiro FUJIWARA
English language abstract of JP 9-316286

PATENT ABSTRACTS OF JAPAN

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(54) THERMOPLASTIC ELASTOMER COMPOSITION AND COMPOSITE MOLDING

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a thermoplastic elastomer composition and composite moldings that are very elastic as less than 45 Shore durometer hardness as a thermoplastic elastomer, free of such problems as tacky touch and bleeding of a softener, and has higher mechanical strength.

SOLUTION: This thermoplastic elastomer composition comprises (a) 100 pts.wt. of a block copolymer composed of polymer blocks (A) consisting of aromatic monoalkenyl or monocalkenylidene hydrocarbon polymers, and polymer blocks B consisting of partially or completely hydrogenated aliphatic conjugated diene hydrocarbon polymers, (b) 50-400 pts.wt. of an oil-extended olefin-based copolymer rubber that contains 20-150 pts.wt. mineral oil-based softener per 100 pts.wt. of the olefin-based copolymer rubber, (c) 2-100 pts.wt. of polyolefin resin, and (d) 50-350 pts.wt. of a mineral oil-based softener, and in order to obtain this thermoplastic elastomer composition, a mixture of the whole quantity of component (b) and a part or while quantity of components (a) and (c) is heat-treated in the presence of an organic peroxide to partially crosslink the polymer mixture.

LEGAL STATUS

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